1-1 Functions: Graphically, Algebraically, Numerically, and Verbally

If you stack paper cups, the height increases as the number of cups increases. There is *one and only one* height for any given number of cups, so height is called a **function** of the number of cups. In this course you'll refresh your memory about some kinds of functions you have studied in previous courses. You'll also learn some new kinds of functions, and you'll learn properties of functions so that you will be comfortable with them in later calculus courses. In this section you'll see that you can study functions in four ways.

Objective

Work with functions that are defined graphically, algebraically, numerically, or verbally.

In this exploration, you'll find an equation for calculating the height of a stack of paper cups.

EXPLORATION 1-1: Paper Cup Analysis

1. Obtain several paper cups of the same kind. Measure the height of stacks containing 5, 4, 3, 2, and just 1 cup. Record the heights to the nearest 0.1 cm in a copy of this table. State what kind of cup you used.

Number	Height (cm)
1	
2	
3	
4	
5	

2. Plot the points in the table on graph paper. Show the scale you are using on the vertical axis.
3. On average, by how much did the stack height increase for each cup you added? Show how you got your answer.
4. How tall would you expect a 10-cup stack to be? Show how you get your answer. Would this be twice as tall as a 5-cup stack?
5. Let x be the number of cups in a stack, and let y be the height of the stack, measured in centimeters. Write an equation for y as a function of x.
6. What is the name of the kind of function whose equation you wrote in Problem 5?
7. Show that your equation in Problem 5 gives a height close to the measured height for a stack of 3 cups.
8. Use your equation to predict the height of a stack of 35 cups. Round the answer to 1 decimal place.
9. What are the names of the processes of calculating a value *within* the range of the data, as in Problem 7, and *outside* the range of data, as in Problem 8?
10. A cup manufacturer wants to package this kind of cup in boxes that are 45 cm long and hold one stack of cups. What is the maximum number of cups the box could hold? Show how you got your answer.
11. What did you learn as a result of doing this exploration that you did not know before?